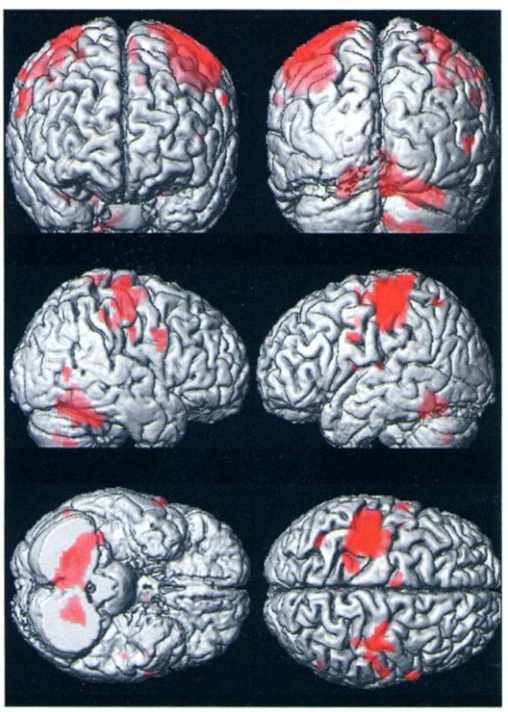
NEUROSCIENCE

A Ruckus Over Releasing Images of the Human Brain

A plan to have brain scientists deposit data in a public center at Dartmouth has drawn a flurry of objections; researchers are drafting data-sharing principles

For most of this summer, leading brain researchers have been fuming over a plan to force them to share raw data. They became upset when Michael Gazzaniga, a psychologist at Dartmouth College in Hanover, New Hampshire, told researchers publishing functional magnetic resonance images of the brain in the journal he edits—the *Journal of Cognitive Neuroscience* (*JCN*)—that they are expected to submit their raw data to a public database he is developing at Dartmouth. They became more agitated when a representative of the Dartmouth database implied that *JCN* may not act alone: Other editors, he told a meeting of brain mappers, would also insist that authors submit their raw data to Dartmouth.

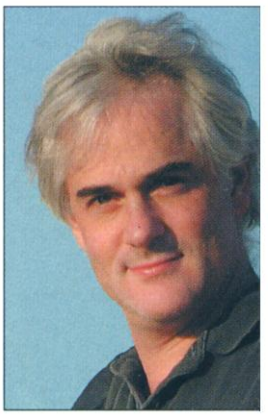
Those events touched off a rebellion. Galvanized by the Dartmouth project, brain scientists have spent the past 10 weeks e-mailing one another and organizing detailed responses. They complain that the Dartmouth archive—which is getting under way this fall—is not ready for prime time. They warn that if the project goes forward as planned, it could compromise the privacy of research subjects, get tangled up in technical knots, and rob authors of the credit they deserve. But even as they rattle off these complaints, a few brain scientists also concede that Gazzaniga's preemptive move may have done some good: It has got everyone talking about how to build a public database that really works. Such a database would be useful for combining results from different studies.



Motor activation. A male volunteer held open and closed his right hand at intervals during a 4-minute fMRI scan, yielding six perspectives in which motor areas of the left brain are highlighted.

Last month, the Organization for Human Brain Mapping (OHBM)—a coalition of scientists around the world interested in imaging the brain—responded to the commotion by establishing a task force under the leadership of Jonathan Cohen, a psychologist at Princeton University. His task: Elicit a consensus and draw up a set of data-sharing "guidelines" supported by the entire field. This will be their response to the Dartmouth initiative, laying down ground rules for cooperation. "For the journals," says Cohen, "we want a list of things they might want to consider before they decide to endorse any database." For authors, the panel will try to establish guidelines on such incendiary issues as how long it's reasonable to withhold data. Cohen plans to have a draft ready for review by the OHBM executive council in "late October," before the Society for Neuroscience meeting in November.

Many leaders in the brain-imaging community say the task force will have a tough job finding an approach to data-sharing that people can agree on. The complexities of reporting experimental results from brain scans, they note, are greater than in fields such as genome sequencing and crystallography, where the experimental protocols are standardized and the data are far more concrete. Many feel that the Dartmouth group doesn't appreciate these difficulties. According to one prominent leader who requested anonymity: "It was a political tour de force that they got the money [to establish the database]," but "they're totally clueless about what they're up against. Hopefully, they're learning."



Consensus seeker. Jonathan Cohen heads a group writing new guidelines.

The scientists who started the rumpus seem to be taking the flak in stride. Gazzaniga, a founder of the Cognitive Neuroscience Society and reputed by peers to be a scientific impresario and skilled fund-raiser, says: "I actually was blindsided by this whole thing. I was talking to people who think this is a great idea and were trying to help make it work. Then, bingo, we get the other side." Although he has recently softened his demand for immediate data release, he says friends have advised him that the backlash he's seeing is normal: "People yell and scream and demand a hold on the data," he says, and "I understand their concerns. ... There will be a few bumps and noises, and then it will smooth out."

Marcus Raichle, a brain-imaging researcher at Washington University in St. Louis and chair of Gazzaniga's database advisory board, adds that the government "has provided the money for us to generate this valuable data, and it ought to be used in the most efficacious way. ... If the people doing the human genome and chemists and others do this kind of databasing, we should be doing it as well."

Build it, but who will come?

The Dartmouth project began, Gazzaniga says, when he seized an opportunity to fund an old idea. The notion of creating a shared archive of brain-imaging data "had been kicking around the community for a long time, and nobody was doing anything about it," according to Gazzaniga. When the National Science Foundation (NSF) showed an interest in making "infrastructure" grants to beef up the biology end of social and cognitive science, Gazzaniga moved. He proposed a public archive of magnetic resonance imaging (MRI) of the human brain. After clearing an NSF technical review, the project won a 5-year, $4.5 million grant, including a small contribution from the National Institute of Mental Health, and an additional $1 million from the Keck Foundation (*Science*, 29 October 1999, p. 880).

Computer scientists are enthusiastic about the project, Gazzaniga says. They believe they can use the archive to "come up with new ways to do meta-analyses, new ways of mining the data" to discover connections in the brain that aren't detectable in a

CREDITS: (LEFT TO RIGHT) COURTESY J. VAN HORN AND S. GRAFTON/DARTMOUTH BRAIN IMAGING CENTER; STEPHANIE ASTON-JONES

single experiment or set of studies. Gazzaniga also says graduate students at universities that can't afford to run a sophisticated brain-scanning laboratory will be able to tap into and use high-quality data at the new center.

Money in hand, Dartmouth assembled the machines and the staff in 1999, and Gazzaniga prepared to launch the National Functional MRI Data Center (NfMRIDC) in the fall of 2000. But when Gazzaniga asked for submissions, many scientists balked, arguing that the whole project was premature. The field hasn't even agreed on a standard format for reporting data, they say.

Cohen and others note that archiving has long been a "knotty issue." OHBM members have sparred over proposals for a single data file format, and a decade-old effort—a consensus brain map begun by neuroscientist Peter Fox at the University of Texas Health Sciences Center in San Antonio—has had difficulty getting useful input. Cohen, for example, says that because of these challenges, the Texas project "has not been an unmitigated success." Images are often made to assess brain changes in subjects performing various behavioral tasks, and one U.S. government researcher who asked not to be named says: "The big problem was how to describe the behavioral task in sufficient detail that the data would be meaningful."

John Mazziotta, editor of the journal *NeuroImage* and leader of another consensus-building effort called the Probabilistic Atlas of the Human Brain at the University of California, Los Angeles (UCLA), agrees that "we need technical tools first" before creating a common database. For 7 years, he says, his group and other major brain-imaging centers have been trying to create a toolkit to describe the architecture of the brain. "It still isn't ready," he concedes. He notes that even within a lab, there are great variations in the behavior examined, the types of stimuli used, the methods of recording responses, and the analytical software used.

Dartmouth's solution to the compatibility problem is to finesse it, at least for now. Staff engineer Jeff Woodward says the database will receive data in any format authors want to offer. "Methods of converting from one format to another are pretty well known," Woodward says, and the center will convert archived files to the format requested by the user. "At this point, we don't want to try to impose any standard," he adds, as the technology is changing so rapidly.

Compulsory sharing?

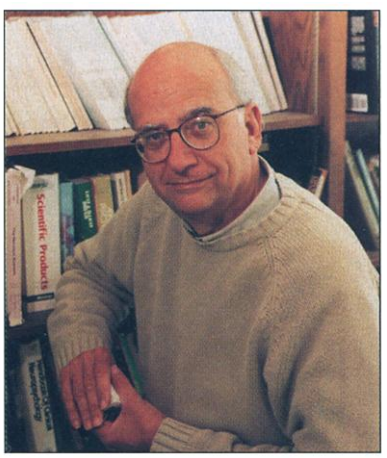
The skirmishing over technical standards pales in comparison to the fighting over whether authors should be compelled to release their raw data to a database. Raichle believes that past efforts like the Texas project suffered because data submission was "totally voluntary." He likes Gazzaniga's solution: Ask everyone to adhere to a new norm of releasing their data to the archive as a condition of getting a paper published.

To advance this policy, Gazzaniga says, he consulted leading journal editors by e-mail. He says most responded favorably. And to set an example, he adopted the policy for *JCN*. He commissioned a dozen papers by leading researchers for a special edition of *JCN* and asked authors to submit supporting data to the NfMRIDC. All agreed. Gazzaniga also wrote to recently published *JCN* authors inviting them to submit source data.

One of those who received Gazzaniga's invitation, Isabel Gauthier, a psychologist at Vanderbilt University in Nashville, Tennessee, responded with a public dissent. She and about 40 colleagues co-signed a letter to leading journals opposing release of data on publication. (Gauthier's letter and responses from Gazzaniga and others are on her Web site, www.psy.vanderbilt.edu/faculty/gauthier/fmridc_letter.html)

Gauthier stresses the author's right to control her own work, noting in her letter that the raw data from a set of experiments may produce more than one paper and shouldn't be released with the first publication. "The nature of fMRI data," Gauthier writes, is that it's hard to separate what's "relevant to a published paper from data that is destined to another manuscript." She argues that authors should decide when data are made public.

Gazzaniga's hope that other journals would follow *JCN*'s lead was already beginning to dissolve. When computer scientist Javed Aslam of the Dartmouth center briefed a group of brain mappers in Bethesda, Maryland, in June, he said that major journals endorsed Gazzaniga's data-release policy. But two journal editors in the room got up, according to scientists present, and said they'd never heard of it.



CREDIT: J. MEHLING/DARTMOUTH COLLEGE

Instigator. Michael Gazzaniga is creating a public database of fMRI brain images at Dartmouth College.

Other editors, including *Nature* Editor Philip Campbell and *Science* Editor-in-Chief Donald Kennedy, after receiving petitions from brain mappers, have decided to avoid any fixed policy for now. Kennedy says: "We have not endorsed the *JCN* policy, nor is data release required for publication in *Science*. We ... have decided to wait for a consensus to develop in the imaging community. ..." Campbell has written that the *Nature* journals do not have "any immediate intention of imposing conditions of deposition on fMRI data," as this would be "premature." Arthur Toga, Mazziotta's colleague at UCLA and an editor of *NeuroImage*, adds: "Any individual or autocratic suggestion as to how this should be done is absurd. ... We live for the people who read the journal" and wouldn't try to impose unwanted standards.

Gazzaniga has now amended *JCN*'s policy to state that authors may hold their data private for an undetermined amount of time after submitting an article. But he says he has not retreated from the view that the data must be shared after a reasonable delay.

Seeking a consensus

Over the next few weeks, Cohen's task force will try to determine what the norms should be. Among other issues, the group will consider how to deal with claims that the Dartmouth data-sharing scheme could put personal privacy at risk because raw brain-scanning data can be used to reconstruct a skull surface—even the outlines of a face. Gazzaniga responds that all personal data will be stripped from submissions, and that his team is "working on" a software block that prevents facial reconstruction.

But the lack of a common data format remains a major barrier, one that will not be solved without the cooperation of the entire field. OHBM past president Karl Friston of the Wellcome Department of Cognitive Neuroscience at University College, London, U.K., says that OHBM leaders recognized long ago that establishing analytical comparability is the toughest issue to resolve. He believes that if all researchers had the software needed to analyze experimental results from other laboratories, data sharing would occur spontaneously. For that reason, he says, Cohen and other leaders of OHBM have been working with the National Institutes of Health to create publicly available software tools.

It seems risky to try to create a shared database before a set of common analytical tools is in hand, Cohen says. But for the moment, he must deal with the "acute" issue of deciding whether—and how—the field should help the new Dartmouth data center get under way. And he says he feels a heavy responsibility: His entire field, and people in fields far removed, are watching to see how the brain mappers respond. **–ELIOT MARSHALL**